



March Program Highlights

NASA Satellite Data Augments Center for Disease Control (CDC) Web Portal

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Highlight: For the first time, daily air temperature and heat index values were computed and integrated into CDC's WONDER (Wide-ranging Online Data for Epidemiologic Research) system – an on-line system for data acquisition available for end-users internationally. By making these data publically available through the CDC WONDER, we are providing data to end-users that they could not access previously. The NLDAS (North American Land Data Assimilation) product is based on model reanalysis, remotely-sensed data and ground observations, and consists of a grid surface with ~14 km resolution over North American, and produces an hourly measure. For this project, data were reported as daily averages, and data transferred to CDC WONDER include: maximum and minimum air temperature, and maximum heat index. Data are available by a number of spatial and temporal parameters. End-users can freely download data necessary for their project from the site

Relevance: Providing these data to end-users had considerable significance for end users, as well as researchers across disciplines. Data can be used, for example, for tracking, modeling, and predicting heat events; for assessing the impact of changes in temperature over time on outcomes; for agricultural applications of temperature changes; and others. These data have already been used in determining the association of temperature and the likelihood of a stroke. Observation has shown a risk of stroke increases for people living in hotter *and* colder temperatures. Prior to this data release, these data were not easily accessible to the general population. Moreover, by providing data through the CDC WONDER portal, users access a format coincident with other data available through the portal, making integration of the data more feasible. Notably, these data are the first of 3 major additions to the CDC WONDER through this project (Land Surface Temperature and PM_{2.5} in progress).

NLDAS Max Air Temperature on July 15, 2008

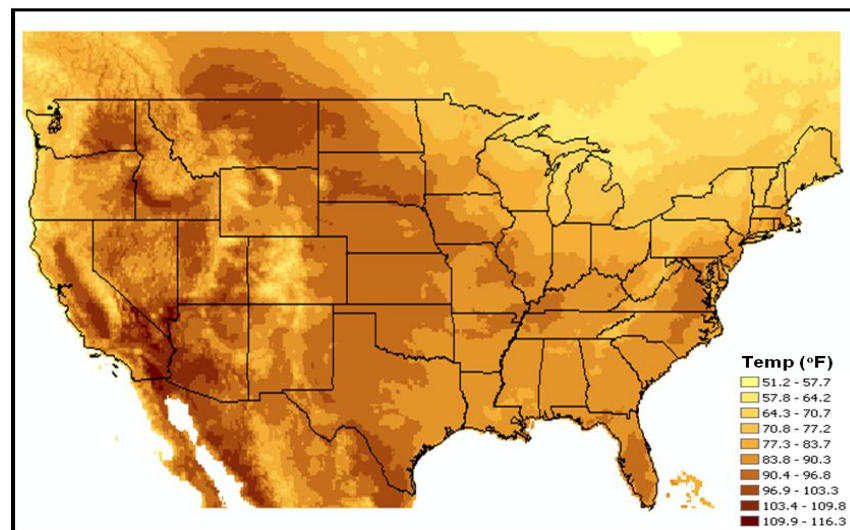


Figure 1 The top panel shows a daily snapshot of the NLDAS maximum air temperature product. The bottom panel shows the query screen for obtaining the NLDAS data on CDC WONDER (temperature and heat index currently available)

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Project Summary: This project has multiple goals, including producing daily estimates of air temperature, solar insolation and PM_{2.5} for the period covering 2003-2008; linking these estimates to data from the REasons for Geographic And Racial Differences in Stroke (REGARDS) study in order to determine associations between these several environmental factors and cognitive decline and other clinical outcomes; and providing these data to end-users through the CDC WONDER portal.

Earth Science Products: This project uses: NLDAS-2 forcing data for temperature, and solar insolation, and MODIS data for the PM_{2.5} product and LST. Further, this project also uses EPA ground-level measurements of PM_{2.5}.

Technical Description of the Images: The top panel in the figure on the first slide represents different gradations of air temperature for the continental US on July 15, 2008. Brighter colors indicate lower temperatures, while darker shades indicate higher temperatures. This is an example of data that were incorporated into the CDC WONDER system together with the heat index data. The lower panel is a snap shot of the CDC WONDER portal, from which after specifying parameters (measures, spatial parameters, temporal parameters), provides end-users with estimates of air temperature and heat index, to be linked to other environmental and public health data both spatially and temporally. The CDC WONDER portal can be found at: <http://wonder.cdc.gov/NASA-NLDAS.html>

Application to Decision Making: These data will benefit decision making through the increased visibility, and thus use, of the data products. The availability of these data products to end-users in a self-serving, publically accessible platform, will increase the ability of end-users to develop decision support systems that involve temperature, and heat index, and will soon be expanded to include solar insolation and PM_{2.5}. These data have already been incorporated into public health research, that allows end-users to better understand the impact of temperature and solar insolation on health outcomes, leading to better clinical decision making for health-care providers.

Scientific Heritage: This project was built upon two NASA-funded projects. One project was a NASA/MSFC-UAB collaboration in which protocols were developed that allowed the MSFC to receive health data from UAB's REGARDS as per HIPPA regulations and link it in a GIS to Landsat-derived land cover land use data to study the relationship between blood pressure and living environment (Estes et al., 2009). The other project was a NASA-CDC collaboration in which a NASA/MSFC team developed a regional PM_{2.5} surfacing algorithm (Al-Hamdan et al., 2009) for the CDC Environmental Public Health Tracking Program as part of a pilot study entitled "Health and Environment Linked for Information Exchange in Atlanta (HELIX-Atlanta)".

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Estes, M.; Al-Hamdan, M.; Crosson, W.; Estes, S.; Quattrochi, D.; Kent, S.; McClure, L. (2009). Use of Remotely-Sensed Data to Evaluate the Relationship between Living Environment and Blood Pressure. *Environmental Health Perspectives*. 117:1832-1838.

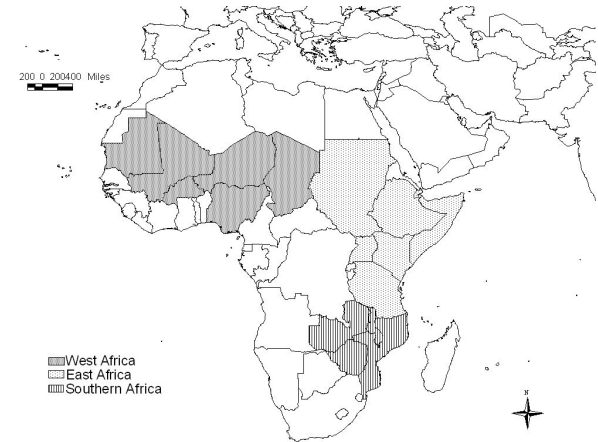
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Satellite Remote Sensing Data is vital to USAID's Famine Early Warning Systems Network (FEWS NET)

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Highlight: In combination with other relevant data such as prices or production, FEWS NET uses satellite remote sensing and ground observations of rainfall and vegetation in order to provide information on drought, floods and other extreme weather events to decision makers. After analysis of 1,342 food security update reports from FEWS NET, the results showed that all 17 countries used rainfall information, agricultural production statistics, food prices and food access parameters in their analysis of food security problems. The reports display large-scale patterns that are strongly related to history of the FEWS NET program in each country. We found that rainfall data was used 84% of the time, remote sensing of vegetation 28% of the time, and gridded models 10%, reflecting the length of use of each product in the regions.

Relevance: USAID's FEWS NET is a cross agency supported decision support tool for actionable, early and quantitative food security monitoring. Approximately 70 million people died of famine in the twentieth century, including an estimated 400,000 in Ethiopia in the 1980s. FEWS NET monitors food security in 20 African countries, Guatemala, Haiti and Afghanistan Understanding how FEWS NET uses satellite and other geospatial information is important to continuing the incorporation of new observations into its system. Through this project, FEWS NET is working to improve communication with food security analysts about remote sensing data products and their utility.



	West Africa	East Africa	Southern Africa
NDVI	36%	46%	3%
RFE	74%	99%	81%
WRSI	17%	10%	6%
Rainfall	100%	100%	100%
Livestock	96%	98%	55%
Production	100%	100%	100%
Pests	37%	16%	14%
Prices	100%	99%	99%
Food Access	88%	91%	89%
Terms of Trade	66%	45%	26%
Civil Insecurity	23%	61%	2%
Disease	63%	85%	53%
Refugee	60%	65%	3%
Malnourishment	43%	64%	32%

Figure 1. Results from the study that show 14 food security relevant terms and their use in Food Security Update reports written in country by food security analysts. We used a computer program to count the number of instances of each keyword in each document. The program reported zero if the word was not mentioned in the document and a one for each time the word was mentioned.

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Project Summary: The objective of the project was to evaluate the use of remote sensing information in comparison with other important factors in the evaluation of food security crises. Here we analyzed 1342 food security update reports from FEWS NET. The reports consider the biophysical, socioeconomic, and contextual influences on the food security in 17 countries in Africa from 2000-2009.

Earth Science Products: This project analyzes how FEWS NET makes use of MODIS products from the LANCE system, AVHRR NDVI, TRMM rainfall products, and climate data records for land cover.

Technical Description of the Images: The table reports the number of times a term was mentioned in FEWS NET food security update reports that are used for routine monitoring of food security and for detecting of emerging food security crises. Remote sensing data are listed as among the factors in the report.

Application to Decision Making: FEWS NET collaborates with international, regional and national partners to provide timely and rigorous early warning and vulnerability information on emerging and evolving food security issues. Situated in USAID's Food for Peace office, FEWS NET provides information that informs the disbursement of hundreds of millions of dollars in food assistance every year. In-country analysts construct an assessment of food availability using production statistics as well as rainfall, temperature, and vegetation data derived from local measurements and from remote sensing to identify abnormally wet and dry periods. The analysts also evaluate market conditions, threats to pastoral resources, availability of wild food, and, ultimately, the agricultural economy as a whole to understand what impact these growing conditions may have on overall food security. Contextual livelihood information is then used to understand how these market and environmental conditions will impact specific groups in each community in the country

Scientific Heritage: Since 2006, three NASA Applied sciences grants have been awarded that have enabled the incorporation of new satellite data into the FEWS NET system. This project has evaluated how these satellite data products are used in the network. The NASA funded projects use the latest computer models to better understand famine and the economic impacts of food crises.

References:

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User Development and Training for the US ForWarn System

Joe Spruce, Stennis Space Center

Highlight: On March 1, 2012, the US Forest Service (USFS) trained personnel from 17 different states to use ForWarn, a forest threat early warning system for the conterminous US developed by the USFS, Stennis Space Center, Oak Ridge National Laboratory, the US Geological Survey, and the University of North Carolina Asheville's National Environmental Modeling and Analysis Center.

Relevance: Forests are a vital natural and economic resource that face a multitude of natural and anthropogenic threats. Automated analysis of NASA MODIS satellite data provides rapid, cost effective, detection of regionally evident forest health problems, and enables resource managers to optimally utilize limited resources. Additionally, ForWarn can help the USFS improve safety by identifying specific areas that need additional observations and reducing the number of flights into dangerous terrain. Capacity building for users are important and necessary for the continued use of the system for decision support.

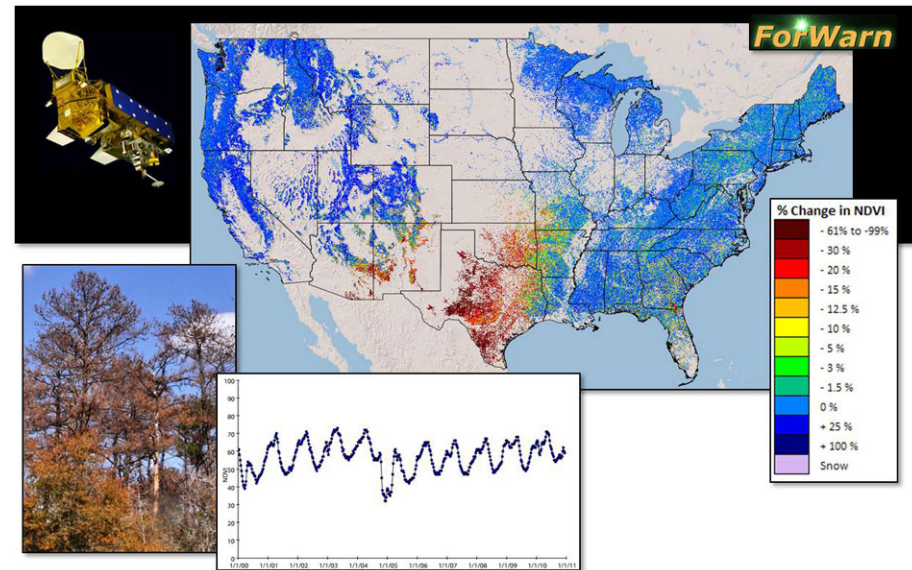


Figure 1 ForWarn uses MODIS data to monitor forests, detect changes in near real time, identify disturbances and probable causes, and presents the information to the public in an easy to use tool. (Image courtesy of the US Forest Service)

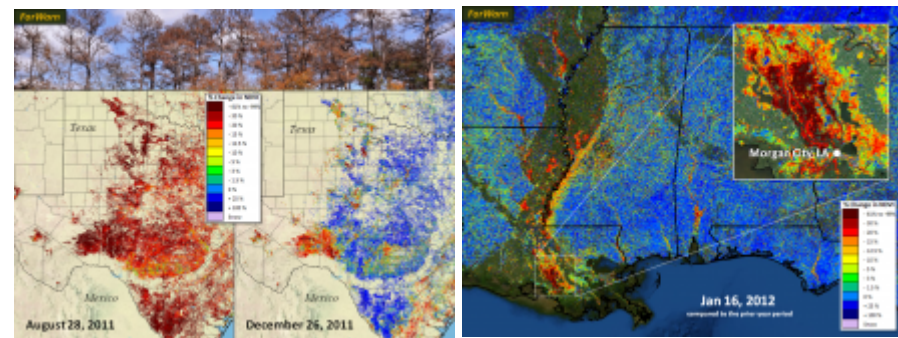


Figure 2 ForWarn has been used to help respond to natural disasters such as (left) the extreme drought in Texas and (right) the unprecedented flooding along the Mississippi River in the spring of 2011. (Image courtesy of the US Forest Service)

Project Summary: This reimbursable project created ForWarn, a near real-time forest disturbance detection capability for the conterminous US, and enabled the new US Forest Service forest threat early warning system (EWS).

Earth Science Products: MODIS MOD13 NDVI products are used to compute historical baselines and eMODIS NDVI derived from NASA Landsat MODIS reflectance data are used for computing NDVI for the current time frame. Developed at NASA Stennis, the Time Series Product Tool and the Phenological Parameter Estimation Tool software packages are used to temporally process historical NDVI products used for baselines.

Technical Description of the Images: Figure 1 depicts a typical CONUS display in the Forest Change Assessment Viewer (FCAV) along with an NDVI temporal profile display. FCAV provides rapid access to a broad range of geospatial and disturbance data. Figure 2 highlights two examples of regional forest disturbance events that were detected with ForWarn's MODIS-based forest % NDVI change products. The ongoing extreme drought in Texas and other parts of the southwest is clearly evident from the precipitous drop in NDVI (red tones) across the region. Unprecedented flooding along the Mississippi River produced localized flooding adjacent to the river and regional flooding when the spillways were opened to save Baton Rouge and New Orleans. The inset shows flooding in the Atchafalaya River basin resulting from opening of the Morganza spillway.

Application to Decision Making: US forests are actively managed environmental and economic resources. ForWarn can detect and identify disturbances caused by wildfires, storms, insects, diseases, human development and anomalous weather. ForWarn enables the US Forest Service and its state and federal partners to quickly identify and track forest disturbances, develop and employ optimal response strategies, and enhance safety by reducing survey flights to those that are essential. ForWarn has been used by federal and state agencies to respond to multiple natural disasters such as tornadoes, floods and drought, and to outbreaks of pests and invasive species.

Capability built/building: Operational use of satellite data products for forestry management and disaster response on a continental scale.

Scientific Heritage: The key scientific and technical achievements are showcased in three journal articles pertaining to the ForWarn EWS activity at large (Hargrove et al., 2009), use of MODIS NDVI products in the detection of gypsy moth defoliation (Spruce et al., 2011), and the use of daily MODIS NDVI change products for assessing hurricane damage to forested wetlands (Ramsey et al., 2011).

References:

- 1.Hargrove, WW, Spruce, JP, Gasser, GE, and FM Hoffman, 2009. Toward a national early warning system for forest disturbances using remotely sensed canopy phenology. Photogrammetric Engineering & Remote Sensing, 75(10):1150-1156.
- 2.Ramsey E, Spruce, J, Rangoonwala, A, Suzuoki, Y, Smoot, J, Gasser, J, and T Bannister, 2011. Daily MODIS data trends of hurricane-induced forest impact and early recovery, Photogrammetric Engineering and Remote Sensing, 77(11):133-143.
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SERVIR Expands its International Reach to User Community

Dan Irwin, Marshall Space Flight Center

Highlight: The Kathmandu, Nepal newspaper *Nagarik* reported on a new project at International Center for Integrated Mountain Development (ICIMOD), using MODIS hotspot data to detect forest fires and communicate that information to government agencies via Short Message Service (SMS)/text.

Relevance: The SERVIR-Himalaya project is using NASA satellite-derived products to reduce delays in identifying areas affected by forest fires. ICIMOD is working with government agencies in identifying the users in various regions of Nepal to receive the SMS alerts. With the impending forest fire season, the article states that the forest departments are eager to employ this latest technique.

Highlight: The El Salvador Minister of the Environment sent an email of thanks and appreciation to USAID for its assistance in supporting LIDAR-based digital elevation maps of the country. This high resolution topographic collection (>1m) is in response to the debris flows that devastated the country in November 2009.

Relevance: Precise terrain mapping is important to El Salvador because the nation has several active volcanoes, including one near the capital, San Salvador. The government needs better terrain maps to support disaster risk reduction. SERVIR provided technical support to enable this acquisition and developed the 2009 maps used by the government to justify funds for this LIDAR collection, as well as reconstruction and disaster prevention activities.



Figure 1. Story from *Nagarik* (Kathmandu, Nepal)

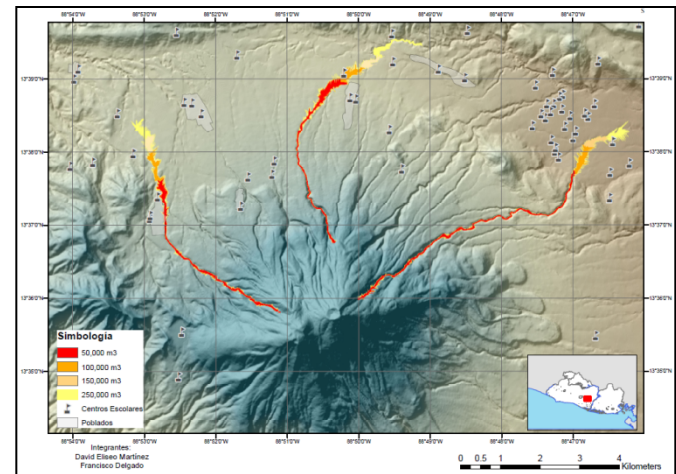


Figure 2. Simulated map depicting lahar threats near a volcano in El Salvador. New wall-to-wall, high resolution LIDAR collection will enable high resolution modeling to support disaster risk reduction.